1 Choice (b) is the only frowny parabola.

For the limit-algebra steps in finding an equation for the slanty line in the figure, note first that, the slanty line is most likely a tangent line. Furthermore, at the point of tangency, $\boldsymbol{f(3) = 3}$, so

$$\begin{aligned} m_{tan} &= f'(3) = \lim_{t\to 3} \frac{f(t) - f(3)}{t - 3} \\ &= \lim_{t\to 3} \frac{(4t - t^2) - 3}{t - 3} = \lim_{t\to 3} \frac{-t^2 + 4t - 3}{t - 3} = \lim_{t\to 3} (-t + 1) = -2 \end{aligned}$$

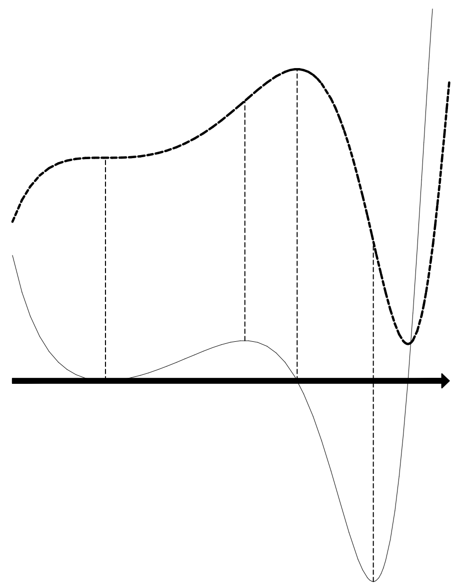
Thus the tangent-line equation is

$$y = 3 + (-2)(x - 3) \qquad \text{or} \qquad y = -2x + 9$$

2 Show limit-algebra steps in finding a $\boldsymbol{f'(x)}$ for the case $\boldsymbol{f(x) = \frac{x}{x+4}}$.

$$\begin{aligned} f'(x) &= \lim_{t\to x} \frac{\frac{t}{t+4} - \frac{x}{x+4}}{t - x} = \lim_{t\to x} \frac{(tx + 4t) - (tx + 4x)}{(t+4)(x+4)(t-x)} \\ &= \lim_{t\to x} \frac{4t - 4x}{(t+4)(x+4)(t-x)} = \lim_{t\to x} \frac{4(t - x)}{(t+4)(x+4)(t-x)} \\ &= \lim_{t\to x} \frac{4}{(t+4)(x+4)} \\ &= \frac{4}{(x+4)^2} \end{aligned}$$

3 The following graph shows, roughly, how g' goes (the thinner curve which has x-intercepts)). The dotted verticals connect features of the g and g' graphs.



4 Check the textbook.

5 (a) $\lim_{x\to 3} (5 - 8x)$

If $\varepsilon > 0$ is given, any δ which does $0 < \delta < \varepsilon/8$ will serve:

$$\begin{aligned} \left|(5-8x)-(-19)\right| &= \left|24-8x\right| = \left|8x-24\right| \\ &= |8|\,|x-3| = 8|x-3| < 8\delta < 8\left(\frac{\varepsilon}{8}\right) = \varepsilon \end{aligned}$$

(b) $\lim_{x\to 2} (3 + 4x - 2x^2)$

If $\varepsilon > 0$ is given, any δ which does $0 < \delta < \min\{1, \varepsilon/6\}$ will serve:

$$\begin{aligned} \left|(3+4x-2x^2)-3\right| &= \left|2x^2-4x\right| = \left|2x(x-2)\right| = \left|2x\right|\,\left|x-2\right| \\ &= 2\left|x\right|\,\left|x-2\right| = 2\left|(x-2)+2\right|\,\left|x-2\right| \\ &\leqslant 2\left\{|x-2|+|2|\right\}\left|x-2\right| < 2\left\{1+2\right\}\left|x-2\right| \\ &= 6\left|x-2\right| < 6\delta < 6\left(\frac{\varepsilon}{6}\right) = \varepsilon \end{aligned}$$

6

(a) $\boldsymbol{f(3) = -1}$

(b) $\boldsymbol{f'(-3/2) = 3}$

(c) $\boldsymbol{f(-1) = 3}$

(d) $\boldsymbol{f(0) = 3/2}$

(e) $\boldsymbol{f(6)}$ "DNE"

(f) $\boldsymbol{f'(0) = -3/2}$

(g) $\boldsymbol{g'(4) = -1/2}$

(h) $\boldsymbol{\int_{-2}^{1} f(x)\,dx = 9/2}$

(i) $\boldsymbol{\int_{1}^{3} f(x)\,dx = -1}$

(j) $\boldsymbol{\int_{0}^{1} g(x)\,dx = 3/2}$

(k) $\boldsymbol{\lim_{x \to 3-} f(x) = -1}$

(l) $\boldsymbol{\lim_{x \to 3+} f(x) = 2}$